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Welcome

To The

Land Processes DAAC Suite of On-line Workshops

LP DAAC Introduction to MODIS Data

Slide 2 - Topics

- Specific topics that you will learn about include the purpose of the LP DAAC, the data that are archived and distributed by the LP DAAC, specific characteristics of MODIS data, and the interfaces from which MODIS can be ordered.

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Slide 3 – Data Centers

- NASA Earth Observation data are available from Distributed Active Archive Centers or DAACs.
- The role of each DAAC is to process, archive, document, and distribute data from NASA's past and current research satellites and field programs.
- Each center serves one or more specific Earth science disciplines and provides data products, data information, services, and tools unique to its particular science.
- The LP DAAC archives, processes, and distributes ASTER and MODIS land processes data products and is located at USGS EROS near Sioux Falls, South Dakota.

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Slide 4 – Web Site

- The LP DAAC is one of several discipline-specific data centers within the NASA Earth Observing System Data and Information System.
- Users can find key information about products and services from our Web site. Our home page and News section provides important updates and information for our users.
- The products section provides information on LP DAAC products and links to other product documentation.
- The Get Data section provides links and information on how to order LP DAAC data.
- The Tools section provides information on useful tools that can be used to manipulate LP DAAC data.
- Finally, the User Community section provides examples of how LP DAAC data are being used by our community of users.

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Slide 5 – LP DAAC Data

- The LP DAAC archives, produces, and distributes data from three sensors on-board two satellites, Terra and Aqua.
- The ASTER and one MODIS sensor are part of the payload on Terra, and one MODIS sensor is on-board Aqua.
- There are currently 20 ASTER products and over 60 MODIS products available from the LP DAAC archive.
- These data are available as grid or swath data, and data distributed by the LP DAAC are in the HDF-EOS format. HDF-EOS is a software library that supports the construction of new data structures, including grid, point, and swath.

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Slide 6 – ASTER & MODIS

- Resulting data from the ASTER and MODIS sensors are very different from each other. Generally speaking, ASTER data are a higher resolution data measuring frequencies of the electromagnetic spectrum that are useful for geological investigations, and MODIS data are at a moderate resolution and collected for research in global change study.
- With a 60 kilometer by 60 kilometer footprint and a 15-meter resolution for the visible bands, ASTER can be considered for use with a more localized or specific area of interest.
- MODIS is a more general or broad type of data that offers daily coverage of the earth in 250-, 500-, 1000-, or 5600-meter resolution. Please take a moment to notice the differences of these two images.
- Both sensors have been found useful for investigations beyond their intended purpose. For example, ASTER is frequently used for volcano and disaster monitoring, and MODIS data has been used for research in forest degradation and invasive species.

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Slide 7 – Electromagnetic Spectrum

- In addition to the imagery that can be created from ASTER and MODIS data, these data also contain data for use in scientific investigations.
- Remote sensing technology creates images by reading sunlight, and as indicated in this image, only a small portion of sunlight is visible to humans.
- The electromagnetic spectrum includes many other bands of light that the human eye is not able to see. Satellite sensors can record data that is otherwise invisible for use in studying the Earth.
- For example, vegetation appears green to us because plants reflect green light from the visible band. However, vegetation also responds very strongly to light from the infrared band. When changes occur in the physical structure or chemistry of a plant, it may not immediately affect how green the plant looks, but it has a big effect on how infrared light is reflected.
- These data can then be used in scientific investigations to assess crop or forest health.

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Slide 8 - Terra

- One MODIS sensor is on-board the Terra satellite, which was launched on December 18, 1999.
- In addition to MODIS, the Terra payload includes CERES, MISR, ASTER, and MOPITT sensors.
- The mission of Terra is "to observe and measure how the Earth's atmosphere, cryosphere, lands, oceans, and life interact."
- The LP DAAC archives and distributes land processes data collected from the ASTER and MODIS sensors on Terra.

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Slide 9 - Aqua

- The Aqua satellite was launched on May 4, 2002, and its payload includes the AIRS, AMSR/E, AMSU, CERES, HSB, and MODIS sensors.
- Similar to Terra, the Aqua satellite provides data on the interaction of the atmosphere, cryosphere, lands, and oceans.
- The LP DAAC archives and distributes land processes data collected from the MODIS sensor on Aqua.

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Slide 10 – MODIS Characteristics

- The broad coverage of the MODIS sensors allow for global coverage with a repeat cycle occurring every 1 or 2 days.
- MODIS is ideal for creating time-series data and models that can be used to predict trends and show patterns within the Earth's land, atmospheric, and oceanic systems.
- Please note the sinusoidal grid, which is the tiling system used for the majority of MODIS products.

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Slide 11 – MODIS Tile

- Here is an example of how a tile over the southwestern United States and northern Mexico appears in the Sinusoidal projection.
- MODIS tools are available at the LP DAAC Web site to reproject, reformat, and mosaick MODIS data.

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Slide 12 – MODIS Bands

- The LP DAAC currently offers over 60 MODIS products, which is due in part to the many bands that are available from the MODIS sensors.
- MODIS bands are available at three different resolutions and cover a range in the electromagnetic spectrum from 0.4 to 14.4 micrometers.

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Slide 13 – MODIS Data

- A complex and interdependent set of science algorithms are used to generate a rich suite of MODIS products.
- MODIS data are available from the LP DAAC as daily or composite products.
- Data collected daily are processed into products with coverage of land based tiles in the sinusoidal grid every 1 or 2 days.
- Composite data are combined data from a defined period, which may be 8 or 16 days, quarterly or annual. The composite data are generally cloud-free data and do not require the user to order the volume of data associated with the daily products.

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Slide 14 – Data Levels

- The LP DAAC archives four levels of MODIS data. These levels of data are either swath or gridded products.
- Swath data are data from polar orbiting satellites that are observed and archived relative to the satellite track. The pattern of observation is nearly regular.
- Most of the MODIS data archived at the LP DAAC are gridded data, which are data the have been processed into a latitude-longitude grid. Swaths of MODIS data are processed to complete the coverage of each MODIS tile in the sinusoidal grid.
- Please take a moment to learn about the various levels of MODIS products at the LP DAAC.

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Slide 15 – Areas of Application

- The LP DAAC MODIS land products can be used in three main areas of application, which are Ecosystem, Radiation and Reflectivity, and Land Cover.
- From these areas of application, the LP DAAC MODIS products are organized into 10 different MODIS data types.

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Slide 16 – MODIS Naming

- The LP DAAC currently has over 20 million MODIS scenes available to order from our archive.
- Naming each data type and data scene is critical to the organization of our archive. Each MODIS data type has a name to help users identify the product that they wish to order.
- MODIS names beginning with MOD are data from the Terra satellite, MYD are data from Aqua, and MCD are products that are processed with data from both sensors.

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Slide 17 – Naming Table

- The sensor information for the name is then combined with the data type.
- For example, the name for Surface Reflectance data collected from the MODIS sensor on Terra is MOD09.
- Next, we will discuss each MODIS data type archived by the LP DAAC.
- Specific information and user guides on each MODIS product can be found in the Products section of the LP DAAC Web site.

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Slide 18 – Surface Reflectance

- In addition to use as a baselayer for mapping and a way of demonstrating broad coverage of land cover trends, the Surface Reflectance product provides a major input used to generate several other MODIS land products.
- These products include Vegetation Indices, Leaf Area Index, Land Cover, Thermal Anomalies, and BRDF/Albedo.

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Slide 19 – LST & Emissivity

- Surface emissivity data is an essential input use to accurately calculate outgoing longwave radiation emitted from the Earth's surface.
- Land Surface Temperature and Emissivity data are used to analyze long-term issues like the greenhouse effect and climate change; estimate sensible heat flux using canopy temperature; derive soil surface temperature to estimate sensible and latent heat fluxes; and help improve methods to evaluate land surface energy balance.

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Slide 20 – Land Cover

- Land Cover data are used in a number of regional and global-scale climate and ecosystem process models.
- These data provide fundamental inputs to parameters that influence biophysical processes and energy exchanges between the atmosphere and the land surface.
- Examples of parameters for climate modeling include vegetation density and surface resistance to evapotranspiration.

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Slide 21 – Vegetation Indices

- The Vegetation Indices correlate with photosynthetic activity at the Earth's surface, where higher values indicate denser vegetation.
- Vegetation Index data facilitates consistent spatial and temporal comparisons of global vegetation conditions for use in phenology and change detection.
- These data also are used as inputs to biospheric and global climate models. Vegetation Indices data are very useful in natural resource management applications, such as forestry and agriculture.

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Slide 22 – Thermal Anomalies/Fire & Burned Area

- Thermal Anomalies/Fire and Burned Area products indicate the location of burn scars, help monitor location and extent of biomass burning, and help with the identifying thermal anomalies.

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Slide 23 – LAI/FPAR

- Leaf Area Index / Fraction of Photosynthetically Absorbed Radiation or FPAR are used to calculate surface photosynthesis, evapotranspiration, annual net primary production, carbon, water cycle processes, and the biogeochemistry of vegetation.
- These data can then be used to assess the health of different ecosystems.

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Slide 24 – Net Primary Productivity

- Net Primary Productivity data are used by investigators to assess the regional or spatial variability in carbon cycle processes, provide inputs to global climate models, and present global estimates of photosynthesis and annual net primary production.

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Slide 25 – BRDF/Albedo

- Bi-directional Reflectance Distribution Function or BRDF data are used to standardize reflectance observations with varying sun-view geometries to a common standard geometry.
- BRDF is a source of biophysical information about the land surface, which allows the specification of land surface albedo, or reflection of the sun's light.
- Albedo provides a fundamental parameter for climate modeling, and maps of land surface albedo are used in global and regional climate models.

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Slide 26 – Continuous Fields

- The Vegetation Continuous Fields product helps overcome the uncertainty of abrupt borders between different land cover classes by representing land cover in each pixel with a proportion of basic land cover components, such as woody tree cover.
- These data can be used to assess the health of vegetation or ecosystems.

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Slide 27 - Applications

- There are a variety of science applications for MODIS data.
- With a broader scale and near-daily coverage, MODIS is useful in studies involving change, impacts, and prediction.
- For example, crop assessments can be made using Vegetation Indices, which allow the investigator to assess drought, normal, or wet conditions.

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Slide 28 – Vegetation Mapping

- Vegetation mapping demonstrates the growth and condition of vegetation and provides data for agricultural assessment, land management, fire danger, and drought assessment.

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Slide 29 - Hazards

- MODIS can be used to help investigators and public officials monitor hazards, including flooding, hurricanes, and wildfires.
- MODIS is particularly useful as change can be detected with its near-daily coverage.
- This series of MODIS imagery provides information on the path of Hurricane Isabel, which was monitored closely through daily acquisitions during September, 2003.

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Slide 30 - Deforestation

- Deforestation and ecosystem data can be investigated using MODIS data.
- This is an image of Java island, acquired on October 29, 2002. The red spots in this image indicate evidence of the slash and burn agriculture practiced on the island.

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Slide 31 – Search & Order

- There are several ways to search, order, and browse for MODIS data.
- Information on each of the ordering interfaces, or clients, can be found in the Get Data area of the LP DAAC Web site.
- Each client is unique and tailored to suit the different needs of the LP DAAC user community. These clients will be discussed in greater detail in future workshops.
- For now, please take a moment to view the differences of each client and visit the LP DAAC Web site or contact LP DAAC User Services for more information.

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Slide 32 – Thank You

- Thank you for viewing the LP DAAC Introduction to MODIS data On-Line Workshop.
- We encourage you to continue with our on-line workshops by visiting the Introduction to ASTER Data Workshop for more specific information about the data that is archived, processed, and distributed by the LP DAAC.

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